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## Towards KM 4.0 - Phases of knowledge production and dissemination

<table>
<thead>
<tr>
<th>Era</th>
<th>Knowledge 1.0</th>
<th>Knowledge 2.0</th>
<th>Knowledge 3.0</th>
<th>Knowledge 4.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>16th – 17th Century</td>
<td>„Age of reason“ - Scientific penetration of nature (Rousseau, Galilie, Newton ...)</td>
<td>Industrial Revolution - Knowledge production permeates all areas of life</td>
<td>Knowledge becomes the dominant production factor</td>
<td>Digitization of everyday life and value creation</td>
</tr>
<tr>
<td></td>
<td>• Development of a „Scientific Method“: systematic-methodical appropriation of new knowledge</td>
<td>• Industrial Revolution - Separation of knowledge (planning / design) and execution (knowledge embedded in machines)</td>
<td>• Emergence of Computer, Internet Artificial Intelligence; Algorithms for routines</td>
<td>• Cognitive, social, collaborative and networked systems, Augmented Intelligence</td>
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<td>• Interaction between scholars and craftsmen, Emergence of „knowledge institutions“ (universities)</td>
<td>• Professionalization of knowledge producers (engineers, doctors)</td>
<td>• Dominance of professional experts and their scientific methods</td>
<td>• Digital penetration of professions and education</td>
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</table>

### Knowledge 1.0
- Scientific penetration of nature (Rousseau, Galilie, Newton ...)
- Development of a „Scientific Method“: systematic-methodical appropriation of new knowledge
- Interaction between scholars and craftsmen, Emergence of „knowledge institutions“ (universities)

### Knowledge 2.0
- Knowledge production permeates all areas of life
- Industrial Revolution - Separation of knowledge (planning / design) and execution (knowledge embedded in machines)
- Professionalization of knowledge producers (engineers, doctors)

### Knowledge 3.0
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- Dominance of professional experts and their scientific methods

### Knowledge 4.0
- Digitization of everyday life and value creation
- Cognitive, social, collaborative and networked systems, Augmented Intelligence
- Digital penetration of professions and education

K.North 2017
Digital Transformation =

*The change associated with the application of digital technology in all aspects of human society* (Bounfour 2016)

Source: EU Digital Transformation Scoreboard 2018
Digital Health Tree

- new norms & values
  - communication
  - transparency
  - participation
  - flow
  - authenticity
  - empathy
  - flexibility - variability
- new technology
  - mHealth apps
  - wearables/insideables
  - adaptiv services
  - seamless health
- connectivity
  - from systems to networks

Source: Belliger & Krieger 2018
Digitally reengineered Financial Services

Credit Decisioning
Big Data based decisioning and Targeting – small business and p2p
Smart Banking with analytics
Digital Banks – mobile and social banks with built in analytics to simplify managing money

Digital Advice
Replacing high-touch with high-tech.
Algorithm based Roboadvisors
Algorithm based advisor to manage goal based portfolio

Mobile Payments, Wallets and POS
Mobile payments as the ultimate enabler of commerce
Crypto-currencies
Blockchain, Bitcoin and the internet value exchange ecosystem disrupting the economics of payments

Informed Enterprise

Customer and Market Intelligence
Risk and Compliance
Industry 4.0 - TruConnect Platform
Digital Citizen Science

Source: Pacheco et al. 2018
HOW CAN KNOWLEDGE MANAGEMENT CONTRIBUTE TO DEVELOP AGILE AND INCLUSIVE ORGANISATIONS IN A DIGITAL AND VUCA ENVIRONMENT?

This Turbulent Environment Has A Name.....

V
For Volatility
Frequent and sudden changes

U
For Uncertainty
Unpredictable patterns of change

C
For Complexity
Complex problems and opportunities co-exist.

A
For Ambiguity
Contradictions and confusion – unsettling scenarios.

An “Adaptive Response” is the only Way in VUCA World
# Challenges of managing knowledge in digital contexts

| Complexity of digital ecosystems | Understanding and being able to act in digital contexts  
|                                | Which knowledge and skills do people need for inclusive access to digitized resources and services? |
| Real-time interactions          | Rapid & ubiquitous availability of current and action-relevant knowledge |
| Big data & large amounts of information | How to integrate, interpret and make sense? |
| New division of work between man and machine | • How do people and machines learn together?  
|                                              | • Which skills are needed for work 4.0? |
| Algorithms “know” & decide      | • Do we understand how machines decide?  
|                                              | • How to ensure that decisions are made within social and legal norms? |
| Digitized collaboration along value chains | Intensified exchange of knowledge across organizational boundaries: How do the partners learn together? |
VALUE GENERATION IN THE DIGITAL ECONOMY - BUNDELING HUMAN AND SYSTEMS INTELLIGENCE
"The knowledge ladder 4.0": Value creation in the digital economy

- New division of labour: man-machine
- Collaboration & networking
- Gamification
- Use of Emojis
- Symbols
- Ubiquitous access
- New forms of leading & learning
- New forms of knowledge-intensive digitally enabled value creation

- Competence
  - + right choice
  - + bundled uniquely
- Actions (Know-how)
  - + application + motivation
- Knowledge (Know-what & why)
  - + context, experience, expectations
  - + meaning
- Information
  - + syntax
- Data
  - + meaning
  - + context, experience, expectations
- Symbols
  - big data analytics
  - block chain technology
  - mail chat, instant messaging
  - social media
  - cognitive systems
  - collaboration software
  - augmented reality
  - simulation
  - liquid feedback
  - advanced assistance systems
- Symbols
  - e-learning

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Three Eras of Automation

If this wave of automation seems scarier than previous ones, it’s for good reason. As machines encroach on decision making, it’s hard to see the higher ground to which humans might move.

**ERA ONE  19TH CENTURY**
Machines take away the **dirty and dangerous**—industrial equipment, from looms to the cotton gin, relieves humans of onerous manual labor.

**ERA TWO  20TH CENTURY**
Machines take away the **dull**—automated interfaces, from airline kiosks to call centers, relieve humans of routine service transactions and clerical chores.

**ERA THREE  21ST CENTURY**
Machines take away **decisions**—intelligent systems, from airfare pricing to IBM’s Watson, make better choices than humans, reliably and fast.

SOURCE  THOMAS H. DAVENPORT AND JULIA KIRBY
FROM  “BEYOND AUTOMATION,” JUNE 2015

© HBR.ORG
Companies see the biggest performance gains when humans and smart machines collaborate.

People are needed to:
• train machines,
• explain their outputs,
• and ensure their responsible use.

AI, in turn, can enhance
• humans’ cognitive skills and creativity,
• free workers from low-level tasks,
• and extend their physical capabilities.
Augmentation

Complimentarity versus Substitution

Augmented intelligence, also referred to as intelligence augmentation (IA) and cognitive augmentation, is a complement to human intelligence. It’s about helping humans become faster and smarter at the tasks they’re performing.

Five Approaches to Augmentation

Augmentation blends the power of AI with the sophistication of human perception, empathy, and experience. In augmentation situations, the knowledge worker can either lead or support the automated decision tool. In robotic surgery, for example, the human surgeon has thus far played the lead role in surgical decisions and actions. In the future, however, enhanced diagnostic capabilities from technologies such as deep learning may mean that, for routine radiology and pathology tasks, machines may play the lead role.

We suggest there are 5 alternative roles for human clinicians in which different forms of augmentation take place:

- **Process Design Role:** Clinicians or managers can play a process design role in which they focus on how AI supports the process in question.

- **Human Capability Role:** Clinicians can adopt a human capability role in which they primarily employ uniquely human skills such as empathy and interpersonal intelligences.

- **Colleague Role:** Human clinicians may play the role of colleague alongside smart machines by evaluating the machines’ immediate outputs, determining if the data seem reasonable, and using this information to augment or inform their own judgments.

- **Niche Role:** Clinicians can fill a niche role for which no technology has yet been developed and likely will not be developed because it would not be feasible or economical to do so.

- **Development Role:** Clinicians can also play a development role with respect to AI technologies that other clinicians will use. In this role, they may work as researchers or in collaboration with AI vendors.

Artificial Intelligence and the Augmentation of Health Care Decision-Making
https://catalyst.nejm.org/ai-technologies-augmentation-healthcare-decisions/
Financial advice: Robos, Humans and Hybrid solutions

It remains to be seen, however, what the optimal evolution of this equation will be:

Will the Robos become more human or will the humans become more robotic?

### Five Paths Toward Employability

People have alternatives for how they’ll work with machines. Here’s a look at them in one realm: marketing.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEP UP</strong></td>
<td><strong>STEP ASIDE</strong></td>
<td><strong>STEP IN</strong></td>
<td><strong>STEP NARROWLY</strong></td>
<td><strong>STEP FORWARD</strong></td>
</tr>
<tr>
<td><strong>HOW YOU ADD VALUE</strong></td>
<td><strong>EXAMPLE</strong></td>
<td><strong>HOW YOU PREPARE IF THIS IS YOUR STRATEGY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>You may be senior management material—you’re better at considering the big picture than any computer is.</td>
<td>A <em>brand manager</em> orchestrates all the activities required to position a brand successfully.</td>
<td>Get that MBA or PhD and constantly challenge yourself to gain broader perspective on your work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You bring strengths to the table that aren’t about purely rational, codifiable cognition.</td>
<td>A <em>creative</em> can intuit which concept will resonate with sophisticated customers.</td>
<td>Develop your “multiple intelligences” beyond IQ and gain tacit knowledge through apprenticeships.</td>
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<tr>
<td>You understand how software makes routine decisions, so you monitor and modify its function and outputs.</td>
<td>A <em>pricing expert</em> relies on computers to optimize pricing on a daily basis and intervenes as necessary for special cases or experiments.</td>
<td>Pursue some STEM education and keep updating your business domain expertise.</td>
<td></td>
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</tr>
<tr>
<td>You specialize in something for which no computer program has yet been developed (although theoretically it could be).</td>
<td>A <em>“wrap advertising” specialist</em> has deep expertise in using vehicles as mobile billboards.</td>
<td>Look for a narrow niche and master it by doing the work with focus and passion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You build the next generation or application of smart machines—perhaps for a vendor of them.</td>
<td>A <em>digital innovator</em> seizes on a new way to use data to optimize some key decision, such as cable video ad buys.</td>
<td>Stay at the cutting edge in computer science, artificial intelligence, and analytics. Learn to spot candidates for automation.</td>
<td></td>
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</tr>
</tbody>
</table>

*Source: Thomas H. Davenport and Julia Kirby from “Beyond Automation,” June 2015*
IMPLICATIONS FOR LEARNING AND KNOWLEDGE MANAGEMENT
Single-loop learning: consists of adapting to environmental changes through action.

Double-loop learning: induces a change in values with regard to the theory of use and strategies. This learning is the only one that enables the values and standards governing theories of use and organisation to be called into question.

Triple-loop learning: “learning about learning” or “learning to learn”

Source: Argyris, C; Schoen D. (1978) Organizational learning: a theory of action perspective. Addison-Wesley
**"Single Loop" Learning and knowledge management**

Provide operational learning and knowledge services, using digital footprints and curating knowledge flows

<table>
<thead>
<tr>
<th>What?</th>
<th>How?</th>
<th>Who?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and accompany diverse forms of (machine) learning,</td>
<td>Mobile learning; needs-based learning in interaction between man and machine; prepare &quot;knowledge nuggets&quot;; microlearning near the workplace; training of machine-learning algorithms how to perform</td>
<td>Learning Designer, Learning Guides, Learning Coaches, HR Development, “Machine trainers”</td>
</tr>
<tr>
<td>Enhance collaboration</td>
<td>Design digital networking/collaboration platforms, Develop and coach good practices for using communication channels, media and formats</td>
<td>Platform and Community Manager, HR, Innovation Manager leaders and users</td>
</tr>
<tr>
<td>Ensure ubiquitous and curated flows of information and knowledge</td>
<td>User-oriented preparation and bundling of information and knowledge using the &quot;digital footprint&quot;; develop comprehensive navigation structure; implement and maintain mobile apps;</td>
<td>Topics experts, Data Scientists, Communities of Practice, Business Unit Curators</td>
</tr>
</tbody>
</table>
Knowledge curators

Curators are responsible for assembling, cataloguing, managing and presenting/displaying artistic and cultural collections.

Overcoming fragmentation

What organizations need is an integrated and scalable (in terms of scope and tie strength) approach that seamlessly keeps together synchronous and asynchronous exchanges, team / departmental / enterprise wide scopes, multiple communication channels (email, chat, activity streams, etc), the possibility to open conversations beyond the boundary of the organization (customers, citizens, patients, researchers, experts, suppliers) as the world is becoming more porous, transparent, fluid and collaborative.

https://postshift.com/turning-noise-into-knowledge/
The product and service portfolio

Job profiles defining relevant competencies

Well structured information, training nuggets, sale apps...
<table>
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<th>Who?</th>
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<tr>
<td>Review and identify critical knowledge</td>
<td>questioning of action-guiding theories and assumptions; future workshop; critical review of business models; future-oriented knowledge accounting; participatory strategy process; Technology Roadmap, After Action Reviews</td>
<td>Knowledge managers, strategy teams, business development, human resources development, R &amp; D, IT, information privacy specialists</td>
</tr>
<tr>
<td>Reconcile human learning and machine learning, Explain algorithm behavior and decisions</td>
<td>Review learning in the interaction between man and machine; Explain domain knowledge; verify the content and logic of processes with experienced practitioners; monitor machine learning; Reflect weak points and risks of the man-machine system;</td>
<td>experienced practitioners in the application of &quot;intelligent&quot; systems coach topic experts, users, knowledge engineers, machine learning experts, ethics councils</td>
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### Significant Change for Bosch

#### The Social Business Principles

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listen and engage</td>
<td>We listen actively to what people have to say, and engage in social business conversations. We use the insights we gain to create new business opportunities and to improve customer and associate satisfaction.</td>
</tr>
<tr>
<td>Sharing and learning</td>
<td>We are happy to share our experience throughout the Bosch organization. In an atmosphere of social collaboration and co-creation, we continuously learn, adapt, and improve.</td>
</tr>
<tr>
<td>Collective intelligence</td>
<td>We believe in the power of networks. We use input from our colleagues and external stakeholders to spark creative ideas for better products, services, solutions, and decisions.</td>
</tr>
<tr>
<td>Ease of use</td>
<td>Our working environment is intuitive and user-friendly. The entire organization uses Bosch Connect as a common social business platform, which makes our daily work more enjoyable and more efficient.</td>
</tr>
<tr>
<td>Self-organization</td>
<td>Wherever appropriate, teams organize themselves, and assume collective responsibility for the results of their work. We harness the power of communities to act on customer demands and create a more flexible company.</td>
</tr>
<tr>
<td>Transparency as default</td>
<td>As a matter of principle, information is open and accessible for all associates. Communities encourage openness, yet comply with all laws and policies concerning intellectual property and sensitive data.</td>
</tr>
<tr>
<td>Exploration</td>
<td>We are not afraid to explore and try out new things. We dare to tread unfamiliar paths and are open to unconventional ideas. If things go wrong, we don’t blame others. We want to be fast, and our learning cycles are ongoing and thorough.</td>
</tr>
<tr>
<td>Recognition</td>
<td>We create a social business environment based on mutual respect, in which each single voice is heard and valued. In this environment, input is judged on its merits. Serving the best interest of Bosch is all that counts.</td>
</tr>
</tbody>
</table>

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Co-Creation of J. Junoki, E. Koter, A. Kumar, M. Meyer, M. Muñoz, S. Weis / 10/2013 © Robert Bosch GmbH 2013. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.
<table>
<thead>
<tr>
<th><strong>Triple Loop Learning</strong> and knowledge management</th>
<th><strong>Questioning and (re)designing the knowledge management and learning system</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Creating meaning and common understanding as a basis for action</strong></td>
<td><strong>Shared vision; promote open, authentic, credible communication; Effectiveness of communication channels, media and formats is questioned</strong></td>
</tr>
<tr>
<td><strong>Encourage renewal, agile learning and reflection</strong></td>
<td><strong>Design learning conditions; establish digital learning management systems; Learning from pilot projects; Setting up reflection-promoting systems; shape Decision-making processes for reflecting and organizing the knowledge lifecycle</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Leaders, internal communication, knowledge managers, HR, IT</strong></td>
</tr>
<tr>
<td></td>
<td><strong>executives, (IT) governance, strategy and organizational dev., change management, learning designers, knowledge managers in business units</strong></td>
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</tbody>
</table>
Towards Learning Flows

## 12 Principles of Modern Learning

### Modern Inquiry Learning

<table>
<thead>
<tr>
<th>Principle</th>
<th>Reality</th>
<th>Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compile</td>
<td>The ability to save and retrieve information in a variety of formats...</td>
<td>gives modern learners virtually unlimited capacity to store and retrieve information.</td>
</tr>
<tr>
<td>Contribute</td>
<td>The ability to participate in more complex projects...</td>
<td>enables modern learners to participate in more complex projects.</td>
</tr>
<tr>
<td>Combine</td>
<td>The ability to reuse and build upon the work of others...</td>
<td>enables modern learners to move beyond individual and isolated projects.</td>
</tr>
<tr>
<td>Change</td>
<td>The ability to quickly obtain feedback from multiple sources...</td>
<td>enables modern learners to continuously improve current work.</td>
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### Modern Self Directed Learning

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<tr>
<th>Principle</th>
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<tbody>
<tr>
<td>Correlate</td>
<td>The ability to generate large amounts of data about our technology-based activities...</td>
<td>enables modern learners to use self generated data to assess and make decisions on future actions.</td>
</tr>
<tr>
<td>Compare</td>
<td>The ability to view the learning artifacts of others...</td>
<td>enables modern learners to learn from what other learners are doing or have done.</td>
</tr>
<tr>
<td>Catch</td>
<td>The ability to participate in virally amplified online activities and events...</td>
<td>enables modern learners to easily identify new and important ideas and content.</td>
</tr>
<tr>
<td>Cooperate</td>
<td>The ability to learn in the same communities as experts and professionals...</td>
<td>enables modern learners to make better decisions about their own learning.</td>
</tr>
</tbody>
</table>

### Modern Social Learning

<table>
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<tr>
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<th>Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting</td>
<td>The ability to access high quality content whenever and in whatever format needed...</td>
<td>enables modern learners to draw upon a diverse range of external resources.</td>
</tr>
<tr>
<td>Communicating</td>
<td>The ability to publish using a variety of media for low or no cost...</td>
<td>enables modern learners to share their ideas and get feedback from others.</td>
</tr>
<tr>
<td>Collaborating</td>
<td>The ability to form learning networks...</td>
<td>enables modern learners to contrast ideas and experiences with other learners.</td>
</tr>
<tr>
<td>Learning Collectively</td>
<td>The ability to form highly interconnected groups around an object of interest...</td>
<td>enables modern learners to engage in shared meaning making.</td>
</tr>
</tbody>
</table>
The major changes of learning & KM in the era of digitalization

Managing human knowledge
Collection
Stability (Best practice)
Inertia

from

to

Managing human & systems' intelligence
Collaboration
Renewal (next practice)
Agility (quick problem solving, on demand learning)